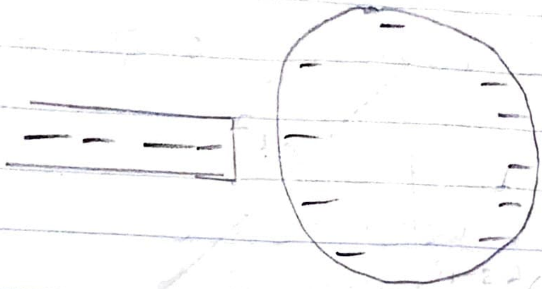
DEPARTMENT: MEDICAL LABOURATORY SCIENCE

PHYSICS ·

MATRIC NO: 19/MHS06/023

1a



b. Let the charges be q_1 and q_2

Combined spheres $= q_1 + q_2 = 5.0 \times 10^{-5} C$

According to columb's law

$|q_1| = q_1$ and $|q_2| q_2$

Now $F = \frac{Kq_1 q_2}{r^2} = 1.0N$

Product of charges:

$q_1 q_2 = (1.0N) \frac{r^2}{K}$

$(1.0N)(2.0m)^2 8.99 \times 10^9 N \cdot m^2 c^2 = 4.449 \times 10^{-10} c^2$

two equations for the unknown q_1 and q_2

$q_2 = 5.0 \times 10^{-5} \ldots q_1$

$q_1 q_2 = 4.449 \times 10^{-10}$

$q_1 (5.0 \times 10^{-5} q_1) = 4.449 \times 10^{-10}$

$(5.0 \times 10^{-5} q_1 - q_1^2) = 4.449 \times 10^{-10}$

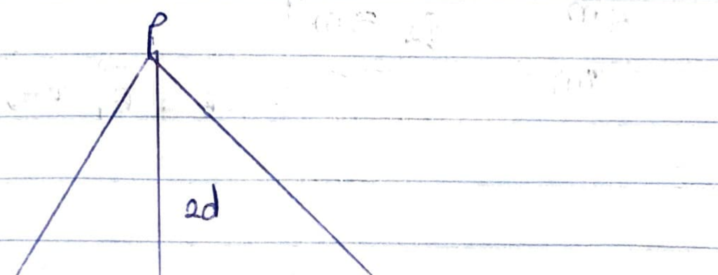
$q_1^2 - (5.0 \times 10^{-5} c) q_1 + 4.449 \times 10^{-10} = 0$

Using quadratic formular

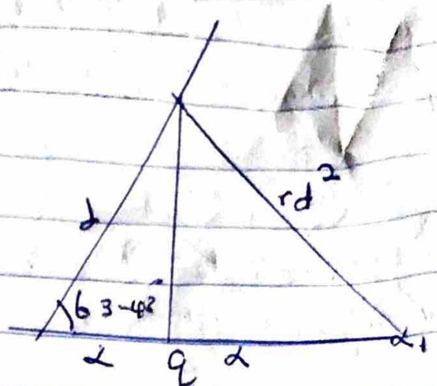
$$q_{1,2} = \frac{(5 \times 10^{-5}) \pm \sqrt{(5 \times 10^{-5})^2 - 4(4.449 \times 10^{-10})}}{2}$$

$q_1 = 3.84 \times 10^{-5} c$, $q_2 = 1.16 \times 10^{-5} c$

1c



Solution



$\sqrt{2d^2+d^2} = d\sqrt{5} = \frac{t = 2d}{d}$

$d = 0.5$

2.

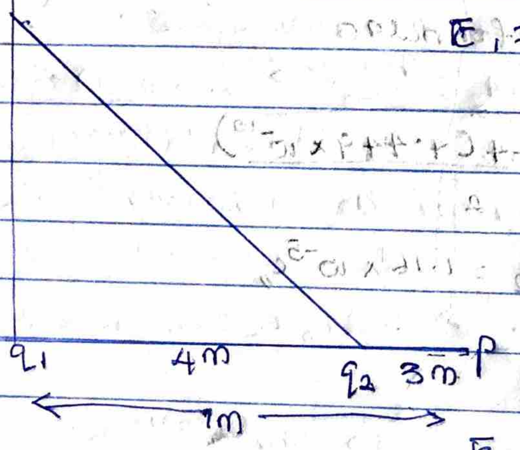
electric field	electric field intensity
It is a region of space in which electric charge will experience an electric force	while the strength of electric field at any point in space which is called electric field intensity

2b $q_1 = 8nC$ at origin $q_2 = 12nC$ on x-axis at $x = 4m$

i) net electric field at point P on the x axis at $x = 7m$

ii) electric field at a point Q on the axis at $y = 3m$ due to the charges.

i



$E_1 = \frac{kq_1}{r^2} = \frac{9\times10^9 \times 8\times10^{-9}}{7^2}$

$= 1.469 N/C \approx 1.5$

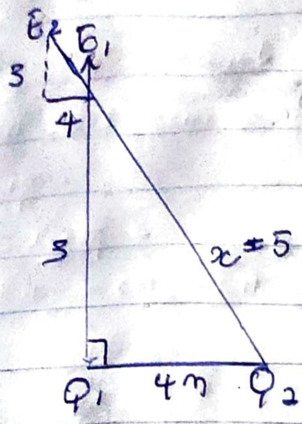
$E_2 = \frac{kq_2}{r^2} = \frac{9\times10^9 \times 12\times10^{-9}}{7^2}$

$= 12 N/C$

$\vec{E}_{net} = \vec{E}_1 + \vec{E}_2 = (1.5 + 12) N/C$

$= 13.5 N/C$

a: $\vec{E}$ at point Q on the y axis at $y = 3m$ due to charge



$c^2 = a^2 + b^2$

$c^2 = 4^2 + 3^2$

$c = 5$

$E_1 = \frac{kQ_1}{r^2} = \frac{9\times10^9 \times 8\times10^{-9}}{3^2}$ $E_1 = 8N/C$

$E_2 = \frac{kQ_2}{r^2} = \frac{9\times10^9 \times 12\times10^{-9}}{5^2} = 4.32N/C$

Vector	angle	x-comp	y-comp
e1 = 8N/C	90°	0N/C	8N/C
e_2 = 4.32	38.87°	-3.45N/C	2.59N/C
		Efx = -3.45N/C	Efy = 10.59N/C

$E_{net} = \sqrt{Efx^2 + fy^2}$

E net = 11.2N/C.

5a.) Biot Savart law is an equation that describe the magnetic field created by the current carrying wire, and allows you to calculate it's strength at various point

b. $B = \frac{N_0 I}{2\pi r}$

B = the magnetic field in teslas

N = Permeability of free space

I = Current in the wire, in amps (A)

r = Radius from the wire in meters

These are the magnitude in the magnetic field

4a Magnetic flux is defined as the Strength of the magnetic field which can be represented by line of force. It is denoted as ϕ.

$$\phi = B \cdot dA$$

B $m_e = 9.11 \times 10^{-31}$ kg, $r = 1.4 \times 10^{-7}$ m, $B = 3.5 \times 10^{-1}$ w/m^2

Cyclotron frequency = angular speed $q = 1.6 \times 10^{-19}$

$$F_B = qvB = \frac{m_e v^2}{r}$$

$$m_e v = qBr$$

$$v = \frac{qBr}{m_e} = \frac{1.6 \times 10^{-19} \times 3.5 \times 10^{-1} \times 1.4 \times 10^{-7}}{9.11 \times 10^{-31}}$$

$$v = 8.61 \times 10^{-3} \text{ m/s}$$

$$\omega = \frac{v}{r} = \frac{qB}{m_e} = \frac{1.6 \times 10^{-19} \times 3.5 \times 10^{4}}{9.11 \times 10^{-31}}$$

$$\omega = 6.14 \times 10^{10} e^{-1}$$

4C In 4b we were given parameters; mass of electron $= 9.11 \times 10^{-31}$ kg, radius $= 1.4 \times 10^{-7}$ m, $B = 3.5 \times 10^{-1}$ w/m^2

And we were asked to find cyclotron frequency which is the same thing as an angular speed. It is called cyclotron frequency because it is a frequency of an accelerator called cyclotron.

Recall ω = angular speed

$\omega = \frac{qB}{m_e}$ since cyclotron frequency = angular speed. The cyclotron frequency $= 6.14 \times 10^{-10} e^{-1}$ having a unit of $\frac{1}{T}$ which is the unit of frequency dimensionaly.